

Flight Plan 2011

Analysis of the U.S. Aerospace Industry



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PREFACE

Flight Plan 2011 is being released in stages. Chapter 1, an industry summary, was released in March 2011. As additional chapters are released, the Table of Contents will be updated accordingly.

This report was prepared by aerospace industry specialists on the staff of the Aerospace Team of the International Trade Administration, U.S. Department of Commerce. Questions and comments may be directed to each chapter's primary author, identified at the chapter's end.

We would appreciate attribution when this report is cited, such as "*Flight Plan 2011*, U.S. Department of Commerce, International Trade Administration, March 2011."

Summary

Introduction

The purpose of *Flight Plan 2011* is to report on the state of the U.S. aerospace manufacturing industry from the standpoint of business trends and developments. In this report, we emphasize issues related to U.S. interests in international trade and investment.

Aerospace manufacturers are generally considered to be companies that produce civil¹ and military aircraft, missiles, satellites and other space vehicles, and parts for all of the foregoing.² Census Bureau data on industry output, used in this report, include in the aerospace manufacturing industry companies engaged in aircraft conversion (that is, major modifications to aircraft systems) and aircraft overhaul and rebuilding. For the purposes of this report, we have included also manufacturers of products used at airports or in aviation security.

With the exception of aircraft conversion, overhaul and rebuilding, our report does not cover services related to aerospace manufacturing. These non-covered services include the provision of air transportation (such as by airlines); aircraft repair and maintenance services; aircraft parts distribution; and consultancy services.

Aerospace manufacturing is critical to the President's National Export Initiative (NEI) goal of creating jobs for American workers through a doubling of U.S. exports over five years. U.S. aerospace manufacturers are internationally competitive, accounting for the highest trade surplus of all U.S. manufacturing industries. For the last year in which data is available (2008), more jobs in the United States were supported by exports of U.S. aerospace products than of any other manufacturing or service industry.

The analysis in *Flight Plan* contributed to the development of an NEI aerospace strategy by the Commerce Department's Aerospace Team.

Snapshot of aerospace industry output

We estimate that the value of total U.S. aerospace industry shipments in 2010 was \$171 billion, a decrease of 4.5% from the 2009 figure of \$179 billion.

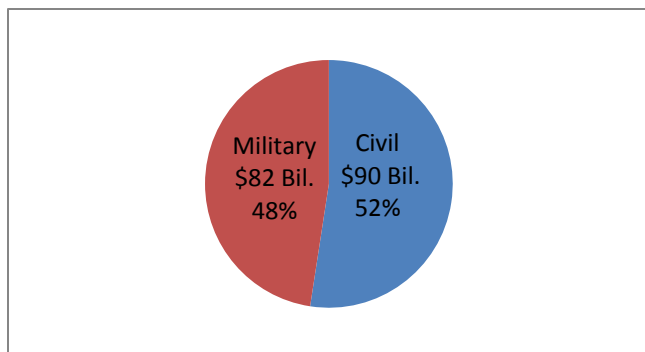
Measured by value, shipments of civil aircraft³ and aircraft parts in 2010, at \$85 billion, constituted one-half of the total 2010 aerospace industry output. The value of civil aircraft and

¹ We use the term "civil", rather than "commercial", because the former refers to *all* non-defense aircraft. "Commercial" refers to *only a portion* of non-defense aircraft, i.e., those that are used in commerce (such as by airlines and charter operators).

² North American Industry Classification System (NAICS) code 3364, "Aerospace Product and Parts Manufacturing."

³ This includes all large civil aircraft, fixed wing general aviation aircraft, and helicopters.

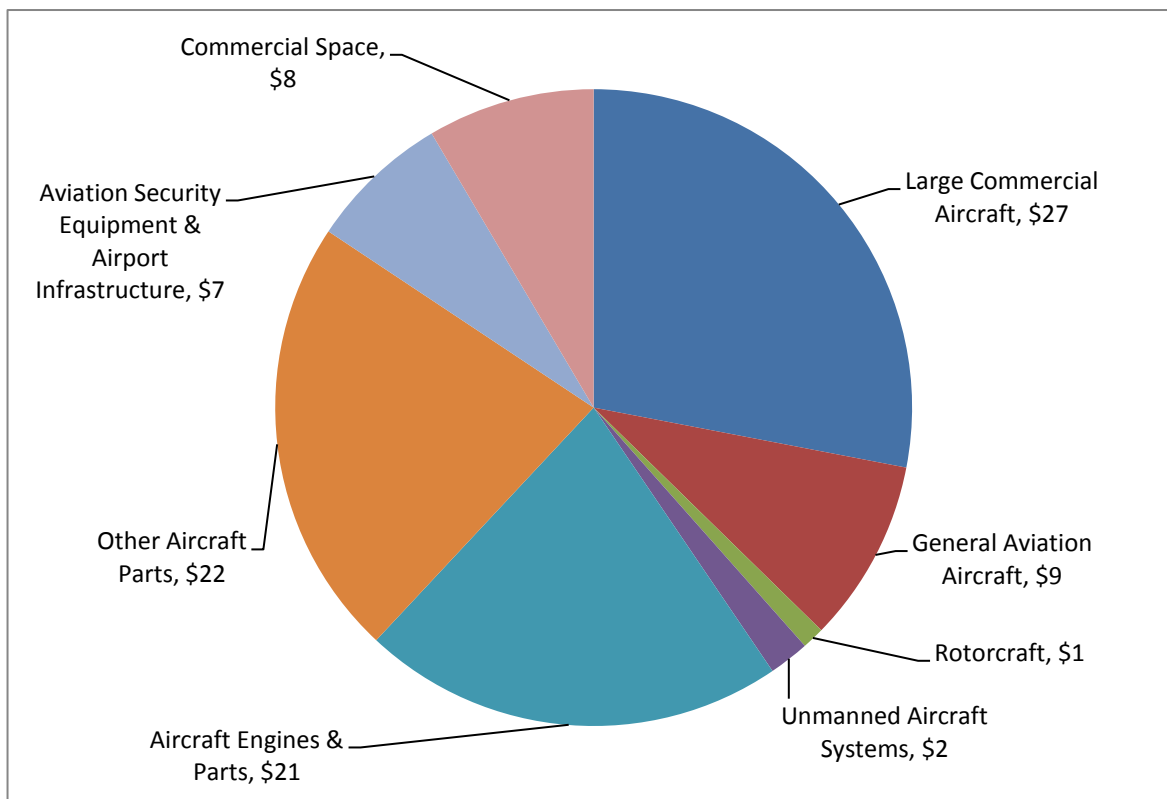
aircraft parts shipped in 2010 was a decrease of almost 13% from the 2009 figure (\$97 billion). While shipments of civil aircraft and aircraft parts were down in 2010, orders for these products rose sharply, increasing by 66% in 2010 from the 2009 order value of \$55 billion.



Estimated total U.S. aerospace industry shipments in 2010 were roughly half and half, military and civil, with the value of civil shipments (\$90 billion) slightly exceeding that of military shipments (\$82 billion). U.S. Government sources of aerospace manufacturing activity did not provide details on specific sectors, e.g., aircraft engines, at the time this summary section was prepared, in March 2011.

The most recent, complete data on the output of aerospace sectors is for the year 2009. We estimate in the pie chart below U.S. output of civil aerospace products for eight categories.

ESTIMATED U.S. PRODUCTION OF CIVIL AEROSPACE PRODUCTS IN 2009 BILLIONS OF DOLLARS



Readers are urged to view the above chart with several caveats. It is aimed at providing only a rough idea of the relative size of the constituent sectors of the U.S. civil aerospace manufacturing industry – and not a precise quantification. We excluded from our analysis entirely the manufacture of military aerospace products. The data for this chart was sourced from disparate organizations (such as the U.S. Census Bureau for aircraft engines and the Aerospace Industries Association for helicopters) that have no commonalities in how they collect and assess industry data.

In certain cases, Commerce Department aerospace industry specialists have had to make estimates associated with particular aerospace sectors. The data is a static snapshot that does not reflect aerospace industry economic trends over time or attempt to explain factors in 2009 that may have had an particularly weighty impact on one aerospace sector but not another. The data is based on a conservative definition of “aerospace manufacturing” that excludes certain activities, such as unspecified “services” that some analysts have included as “manufacturing.”

Overview of individual aerospace industry sectors

Large civil aircraft (LCA) are produced by one U.S. manufacturer, Boeing. Boeing received net orders⁴ for 530 LCA in 2010, more than tripling the number of its net orders in 2009 (for 142 aircraft). Boeing’s single aisle model 737 dominated the company’s 2010 order book, accounting for 486 orders -- almost 92% of total net orders. Boeing delivered 462 LCA in 2010, a slight decrease from the 481 LCA it delivered in 2009.

Major developments in 2010 included clear signals of the emergence of new LCA competitors overseas. In November 2010, the Commercial Aircraft Corporation of China announced the first orders for its C919 model jetliner. Earlier in the year, Montreal-based Bombardier received its first order from a U.S. customer for its CSeries aircraft, the first LCA to be manufactured in Canada. In other developments, difficulties with flight testing of the 787 in late 2010 caused Boeing to further delay the first deliveries of that aircraft. In June 2010, a World Trade Organization dispute settlement panel ruled that much of the government subsidies provided to Airbus was inconsistent with WTO rules. (That decision is pending appeal.)

General aviation (GA) sales fell again in 2010 and are expected to be flat in 2011. Large business jet deliveries continue to be unaffected by the downturn while smaller jet sales are more volatile. GA manufacturers in the United States continued to shed jobs. Embraer is emerging as a strong competitor in the small jet area and is opening a facility to assemble these planes in Florida in 2011. Due to supply chain constraints and the significant number of layoffs at OEMs, it is unclear how the industry will respond to new orders as the economy continues to improve. Sales of bizjets tend to lag economic recovery by one year; piston aircraft tend to track in real time.

⁴ “Net orders” refers to the difference between the number of new orders for aircraft received in 2010 and the number of cancellations received in 2010 for existing orders. Orders that were cancelled in 2010 may have been placed in any of the previous years.

Rotorcraft Industry analysts expect recovery in the rotorcraft sector to lag behind the recovery of fixed wing general aviation (GA) aircraft manufacturing given that the downturn in GA manufacturing preceded that of helicopters. Helicopter shipments are expected to begin increasing in 2012, with China and India prominent foreign markets due to their lack of infrastructure. In 2010, U.S. helicopter manufacturers Bell and Sikorsky conducted research and development aimed at applying “fly-by-wire” technology to civil turbine helicopters. Sikorsky conducted test flights on its new X2 helicopter, with two counter-rotating blades on top and a high-speed pusher-prop in back.

Unmanned Aircraft Systems (UAS) The UAS market is expected to grow rapidly in 2011, driven primarily by military procurement of UAS by the U.S and other countries. The U.S. accounts for the bulk of global UAS production and research and development (R&D) expenditures with the U.S. Department of Defense being the largest consumer of UAS technology in the world. A civil UAS market is beginning to emerge, but its growth is constrained due to lack of airspace access and regulatory and operational standards. The FAA’s Unmanned Aircraft Program Office (UAPO) is expected to publish a Notice of Proposed Rulemaking (NPRM) for small UAS in late-2011 which will provide a process for small UAS to operate in the national airspace under low-risk conditions without undergoing the case-by-case approval process that is currently required. The FAA hopes to publish the final rule by the end of 2012.

Large civil aircraft jet engines The large civil aircraft jet engine market is dominated by U.S. manufacturers GE Aviation and Pratt & Whitney, and U.K. manufacturer Rolls-Royce. These three companies also participate in a number of joint ventures amongst themselves or along with a smaller company or group of companies. These ventures are formed to capitalize on emerging market demand for engines, while at the same time allowing partners to share development and production costs along with risk.

Aside from the continued and increasingly common use of joint ventures for cost and risk sharing purposes, major developments in 2010 relate to development of new engine technologies that reduce engine fuel consumption, noise and emissions. Representative of this trend are Pratt & Whitney’s geared turbofan (GTF) engine and GE Aviation/SAFRAN joint venture CFM’s LEAP-X engine. These engines utilize composite materials and other re-designed components to realize significant fuel savings, while operating more quietly and at lower emissions levels. Trends in the aircraft engine market are linked to aircraft sales, and these engines are the primary options on a number of new aircraft in development including Russia’s United Aircraft Corporation/Irkut MS-21, Japan’s Mitsubishi Regional Jet (MRJ), Canada’s Bombardier C-Series aircraft and the Airbus A320 neo. As these aircraft become operational, engine manufacturers will face increasing pressure to develop more fuel efficient, quieter and clean burning engine options for other large civil aircraft already in service.

Aircraft parts In this report, we use include in “aircraft parts” all components of aircraft (excluding components of aircraft engines) and so-called aircraft “auxiliary equipment”, such as crop dusting apparatus and external fuel tanks. Measured by value, U.S. production of civil and military aircraft parts reached a trough in 2002 and 2003 (with shipments each of those two years at \$21.1 billion). Production increased each year afterward, peaking in 2008 at \$33.1 billion. In

2009, the most recent year for which data is available, U.S. production of aircraft parts contracted by about 5% from the year before, to \$31.4 billion.

We estimate that about 70% of total U.S. production of aircraft parts is comprised of civil parts. During times of economic downturn, as has been the case in recent years, the demand for replacement parts in used civil aircraft increases relative to the demand for parts produced for new aircraft because aircraft operators, such as airlines, are more inclined to extend the life of their existing fleet rather than to acquire new aircraft.

Airports Infrastructure and Aviation Security Equipment Worldwide airport capital expenditures (not counting new/greenfield airports or capital investment in the Middle East or China) was approximately \$34.6 billion (U.S) in 2009 and \$38.5 billion in 2010. China is slated to become the second largest national aviation market in the near future and plans to add more than 80 civil airports to their aviation system by the year 2020. Brazil will host the 2014 FIFA World Cup and the 2016 Olympics, which will require upgrades to airports, air traffic management, aviation security, etc. India plans to increase the number of commercial air service airports from 80 today to more than 500 over the next decade. Such an increase will require India's air-traffic system to be transformed to handle two, three or even four times its current capacity. India plans to invest over \$40 billion in airport infrastructure to help accommodate this projected growth.

The ten leading Middle-East airports will be investing over \$33.7 billion in new capacity by 2012. NextGen upgrades in the United States alone could cost around \$22 billion. Proposed acceleration by TSA of the requirement for 100 percent of U.S-bound international cargo on passenger flights from 2013 to the end of 2011 will require a massive upswing in cargo screening equipment research, development, engineering, and deployment, with the market value of such equipment easily reaching into the billions of dollars.

Commercial space sector In June 2010, President Obama signed a new National Space Policy, which put a much stronger emphasis on the use of commercial space capabilities and international cooperation to meet U.S. Government mission requirements. Additionally, the policy supports U.S. commercial space sector and business interests more than any previous policy by promoting U.S. exports, working to minimize the regulatory burden on the industry, and fostering fair and open international trade through suitable standards and regulations. The policy supports an environment that encourages growth and competitiveness for the U.S. commercial space industry—a big change from previous policies that focused primarily on national security space concerns.

2010 global commercial space launch activities nearly matched those held in 2009, with U.S. commercial launch providers securing 17 percent, or about \$300 million, of the total global market. By definition, commercial satellite manufacturing reflected this flat trend. The satellite manufacturing and launch services industries are expected to remain stable over the next few years, but 10-13 percent growth is expected to continue in the satellite services sector. Such services as direct-to-home television, broadband, and a multitude of mapping applications will continue to increase demand for satellite communications and imaging services for the foreseeable future.

In December 2010, SpaceX achieved what only governments had previously accomplished when the company performed the first successful launch of its Falcon 9 rocket under NASA's "COTS" program, and then successfully recovered its spacecraft after re-entry from low-Earth orbit. The Commercial Orbital Transportation System (COTS) is designed to develop commercial supply services to the International Space Station. SpaceX is a private company, whose family of launch vehicles has been developed without federal support.

Aerospace trade

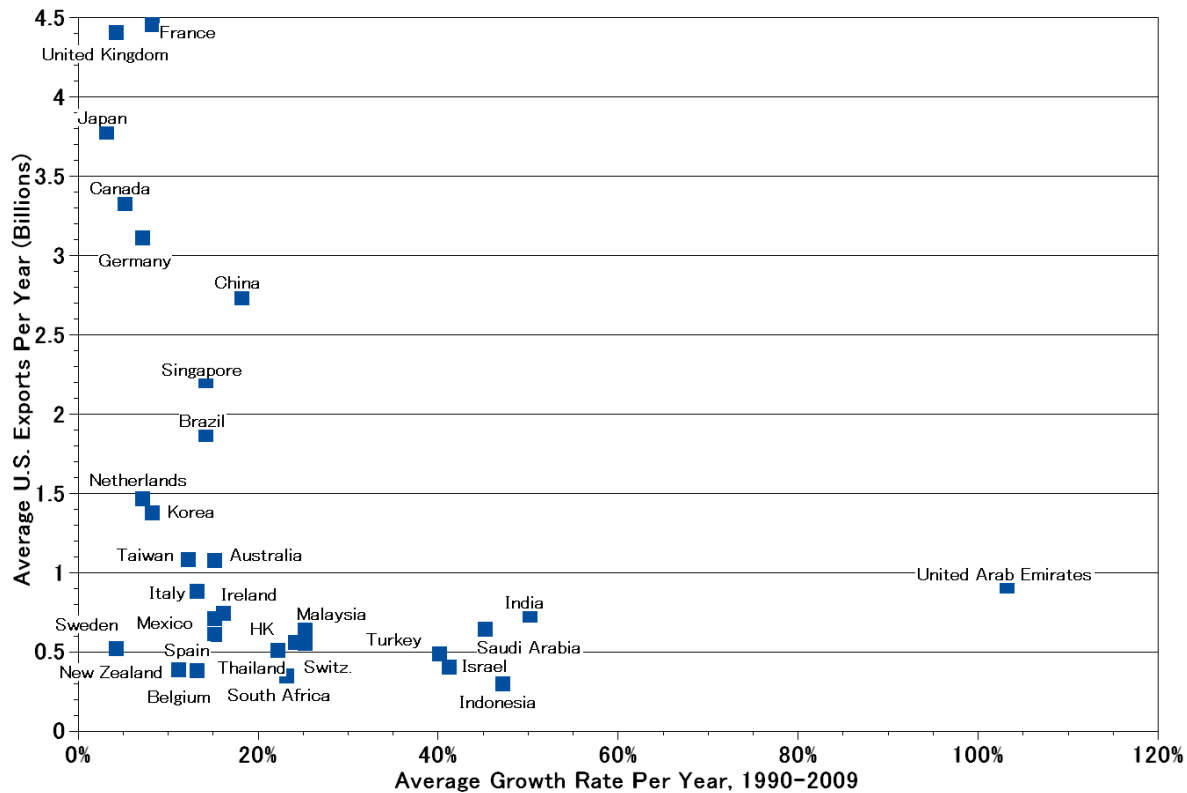
U.S. exports of total civil and military aerospace products in 2010 were valued at \$77.8 billion and U.S. aerospace imports were valued at \$34.2 billion, producing a U.S. aerospace trade surplus of \$43.6 billion. The 2010 aerospace trade surplus was a contraction from the 2009 surplus of \$48.3 billion, resulting from both a year-to-year decrease in U.S. aerospace exports and increase in U.S. aerospace imports.

The top five U.S. export markets accounted for 37% of total U.S. aerospace exports: France, China, Japan, the United Kingdom, and Germany. The top five suppliers to the United States accounted for 75% of total U.S. aerospace imports: France, Canada, the United Kingdom, Japan and Germany.

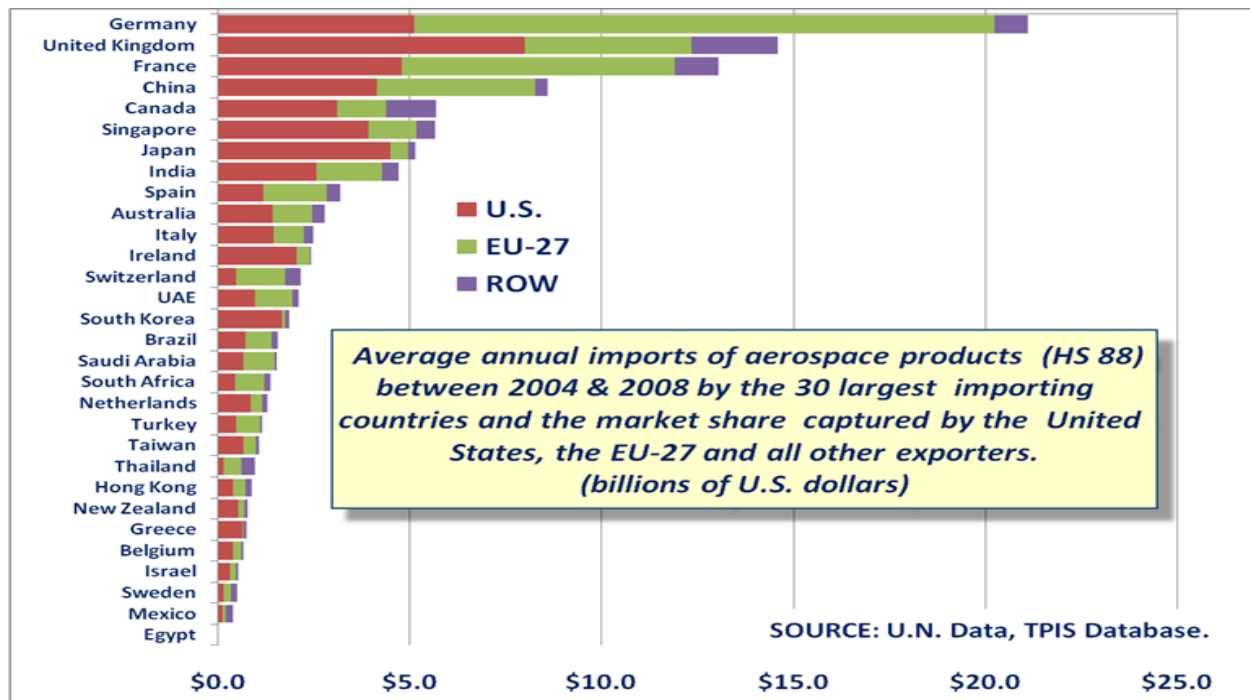
While the composition of total U.S. aerospace industry is roughly 50/50 civil and military, civil aerospace products dominate U.S. aerospace exports. Over the last five years, 86% of all U.S. aerospace exports consisted of civil products.

Over the last two decades, the average annual growth rates in U.S. civil aerospace exports to the largest, legacy U.S. aerospace export markets (such as France, the United Kingdom, Japan and Canada) have been on the order of 5-10%. Average annual growth rates of U.S. civil aerospace exports to smaller, emerging markets (such as India, Saudi Arabia, Israel and Indonesia) have been dramatically higher, on the order of 50%

TOP 30 U.S. CIVIL AEROSPACE EXPORT MARKETS, 1990-2009



U.S. aerospace manufacturers' primary foreign competitors are European. In many of the major national aerospace markets, the United States and Europe have roughly even market shares. Exceptions include Germany (in which Europe has dominated) and Japan (in which the United States has dominated). The large EU share of Germany's imported aerospace products may be at least partially accounted for by the presence in Hamburg of an Airbus aircraft assembly facility which imports parts from other European countries.



Among the major trends in global trade and investment in aerospace products is an acceleration of the interconnectedness between manufacturers in different countries. An extreme example involves the production of CFM56 aircraft engine gearboxes in France by SNECMA. Some of the gearboxes are exported to the United States for assembly in the complete CFM56 engine. The engine may then be exported back to Europe to power an Airbus aircraft, some of which are exported to the United States for use by U.S. airlines.

Among the factors accelerating growth in the global supply chain are governmental policies aimed at fostering an indigenous aerospace manufacturing industry, the need to spread among numerous aircraft component suppliers the risk of bringing to market new aircraft models, and an interest by airframers in having a diversity of suppliers.

Another overarching trend is the move away of a duopoly of aerospace producers (in the United States and Europe) to global market with prominent competitors from many regions. Regional aircraft manufacturers in Brazil and Canada are beginning to produce aircraft that will compete with Boeing and Airbus. Other countries with emerging aerospace industries include China, Japan, India, Israel and Russia.

U.S. competitiveness

In the coming years, the international competitiveness of the U.S. aerospace industry will be shaped by challenges at home and abroad.

A major domestic initiative affecting U.S. aerospace manufacturers is reform of U.S. export controls, especially the International Traffic in Arms Regulations (ITAR). The export of a complete U.S. jetliner may be subject to adjudication under the ITAR if the aircraft contains a single component deemed to be a “munition” (such as certain components of the aircraft engines’ “hot section”.) U.S. manufacturers complain that foreign companies are “designing out” U.S. parts with a view to being able to promote their end use items as ITAR-free.

Other domestic measures concern Federal Aviation Administration (FAA) regulations (such as a pending rule on Safety Management Systems), the extension of tax credits for industry-funded research and development (R&D), the provision of federally-funded aeronautical R&D (NASA and the FAA), and export credit financing by the U.S. Export-Import Bank.

Foreign governments may undertake measures to foster the development of their domestic aerospace manufacturers, sometimes in ways that affect the United States. A major concern has been government subsidies to Airbus. In June 2010, a World Trade Organization (WTO) dispute settlement panel ruled in a case initiated by the United States that many of subsidies provided to Airbus contravened WTO rules. This case likely will have important implications in regard to subsidies being provided by other governments to their aerospace manufacturers, such as Canada. (At the time this report was written, an appellate decision on the Airbus subsidies case was pending. In addition, the European Union initiated counter litigation against the United States, alleging that certain subsidies to Boeing were WTO-inconsistent.)

Other market impediments overseas include tariffs on U.S. exports of civil aircraft and aircraft parts, including by India, Russia, China and Brazil. The lack of sufficient airports or landing slots in some markets, such as India and Japan, is a challenge for U.S. exporters of general aviation aircraft. A requirement to provide “offsets”, well established in connection with military aircraft sales, appears to be increasingly applied to the export of civil aircraft.⁵

The primary author of this chapter is Fred Elliott, tel: (202)-482-1233, fred.elliott@trade.gov.

⁵ Offsets are compensation practices required as a condition of purchase by government owned or controlled airlines. The aircraft seller may be required to transfer technology to the market of the aircraft purchaser, invest in local aerospace manufacturers, and/or purchase aircraft components from local suppliers.